भारतीय मानक
Indian Standard

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फॉउडरी में प्रयोगार्थ पोलीरीथीन ठंडा डिब्बा बाँधने के लिए — विशिष्टि

Polyurethane Cold Box Binder for Use in Foundries — Specification

ICS 73.060.01; 81.080

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Foundry and Steel Casting Sectional Committee, MTD 14

FOREWORD

This Indian Standard was adopted by the Bureau of Indian Standards, after the draft finalized by the Foundry and Steel Casting Sectional Committee had been approved by the Metallurgical Engineering Division Council.

Sand cores with high degree of dimensional accuracy and high productivity are made from ‘Polyurethane Cold Box’ binder system. Clean surface finish, excellent breakdown properties, rapid productivity, low gas evaluation and energy saving are considered to be an additional advantage.

The binder system is comprised of the following three parts:

a) Part A — Binder being a typical phenol formaldehyde resin (liquid) in non-aqueous medium;
b) Part B — Co-binder (liquid) being a mixture of poly isocyanates in non-aqueous medium; and
c) Part C — Catalyst being a volatile amine.

In the polyurethane cold box process, reaction takes place between phenolic resin and polyisocyanate compound in presence of amine gas which acts as a catalyst.

The polyurethane cold box binder system is suitable for different type of castings such as steel, iron and non-ferrous castings.

The binder is phenolic resin with free phenol content greater than 5 percent which is considered as toxic in nature. Therefore, proper guidance for safe handling of product should be provided by the manufacturer.

The hardener is a polyisocynate. It is toxic in nature. Hence proper guidance for safe handling of product should be provided by the manufacturer.

The catalyst is amine based inflammable liquid with low flash point and toxic in nature. Hence proper guidance for handling and storage should be provided by the manufacturer.

The reclamation of sand using the phenolic urethane binder system is not common.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS 2 : 1960 ‘Rules for rounding off numerical values (*revised*)’. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

Indian Standard

POLYURETHANE COLD BOX BINDER FOR USE IN FOUNDRIES — SPECIFICATION

1 SCOPE

This standard covers the requirements of polyurethane cold box binder for use in foundries.

2 REFERENCES

The following standards contain provisions which through reference in this text constitute provision of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision and parties to agreements based on these standards are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below:

IS No.	*Title*
1387 : 1993	General requirements for the supply of metallurgical materials (*second revision*)
1918 : 1966	Methods of physical tests for foundry sand
3018 : 1977	Specification for standard silica sand for raw material testing in foundries
4905 : 1968	Methods for random sampling

3 SUPPLY OF MATERIALS

General requirement relating to the supply of cold box binders shall be as specified in IS 1387.

4 REQUIREMENTS

4.1 Binder

4.1.1 The viscosity of the binder when tested by Ford cup viscometer No. 4 shall not be more than 80 s at the time of receipt when tested at 30ºC.

4.1.2 Within stipulated storage life and condition, binder should not attain a viscosity greater than 100 s when tested at 30°C by above method.

4.1.3 Free formaldehyde content of the binder should be less than 0.5 percent when tested by oxime method.

4.1.4 Within stipulated storage life, the binder shall remain homogenous without forming layers.

4.2 Hardner

4.2.1 The Hardener should be clear dark coloured liquid and homogenous in nature.

4.2.2 Viscosity of the hardener when tested by Ford cup viscometer No. 4 shall not be more than 20 s.

4.2.3 Within stipulated storage life, the hardener should not form any precipitates.

4.3 CATALYST

4.3.1 The catalyst is amine based inflammable liquid with low flash point and toxic in nature.

4.3.2 The catalyst commonly used is tri-ethyl amine (TEA) at flash point 0°C.

4.3.3 The quantity of catalyst should not exceed 20 percent by weight of binder under leak proof condition.

5 PHYSICAL PROPERTIES OF SAND MIX

The physical properties of sand, binder and hardener mix, when tested according to the procedures specified in Annex A, shall be as agreed to between the buyer and the supplier.

6 SAMPLING

Sampling procedure and criteria for conformity shall be as given in Annex B.

7 STORAGE QUALITY

The user shall store the materials as specified by the manufacturer. The period for which a cold box binder system and hardener may be stored without deterioration shall be indicated on the containers by the manufacturer within the shelf life/expiry period.

8 PACKING

The material shall be packed in a suitable container with which the material shall not react.

9 MARKING

9.1 The container shall be legibly marked with the name and type of the material, quantity, manufacturer's name, production batch No., date of manufacturing and date of expiry.

9.2 BIS Certification Marking

The material may also be marked with the Standard Mark.

9.2.1 The use of the Standard Mark is governed by the provisions of the *Bureau of Indian Standards Act*, 1986 and the Rules and Regulations made thereunder. The details of conditions under which the license for the use of the Standard Mark may be granted to manufacturers or producers may be obtained from the Bureau of Indian standards.

10 REQUIREMENTS OF PHYSICAL PROPERTIES OF STANDARD SAND MIX

10.1 Dog bone shaped 65 mm × 22 mm × 22 mm test samples shall be made at equal time intervals of 5 min after the discharging of mixed sand. All the specimens shall be broken immediately after making. The tensile strength of the specimen will show drop in strength values after certain time. This time when tensile strength drops to 20 percent of its first reading shall be considered as bench life of sand mix from the time of discharge.

10.2 Bench life measured as per the above procedure should be as agreed to between the buyer and the supplier considering ambient temperature and humidity.

10.3 Strength by core scratch hardness tester on the sides just after making dogbone/transverse specimen should be checked as required.

10.4 Tensile strength shall be recorded at the intervals of 0th h, 1st h and 24th h of discharge. The 24th h specimen should be subject to following three different curing environments:

a) Open to atmosphere,
b) Wet desiccators, and
c) Dry desiccators.

10.5 Gas content (cc/g) tested at 800-850°C for 3 min.

11 TEST CERTIFICATE

The manufacturer shall also provide a test certificate containing following information on all three parts:

a) Appearance,
b) Colour,
c) Density,
d) Viscosity,
e) Manufacturing date,
f) Expiry,
g) Purity of catalyst, and
h) Storage condition — sealed barrels at ambient temperature under shade.

ANNEX A

(*Clause* 5)

METHODS OF TEST FOR AMINE CURED COLD BOX BINDER

A-1 RAW MATERIALS REQUIRED

A-1.1 Silica Sand

As per following specification or as per IS 3018 shall be used:

Sl No. (1)	Description (2)	Specification (3)
i)	Type of sand	Silica
ii)	Size and shape	Rounded/sub-angular
iii)	A.F.S.	50-55
iv)	L.O.I. at 950°C for 2 h	0.5 percent, *Max*
v)	A.D.V.	5 ml (*Max*) of 0.1(N) HCl 100 g of sand
vi)	*p*H (10 percent in water)	7-8
vii)	Fines (below 150 mesh)	1 percent, *Max*
viii)	Total sieves	3 sieve sand
ix)	Clay content	0.2 percent, *Max*
x)	Moisture content	Nil

A-1.2 Binder

The specified binder under test.

A-1.3 Hardner

The specified hardener under test.

A-1.4 Catalyst

The specified catalyst under test.

A-2 APPARATUS

A-2.1 Core Sand Laboratory Mixer of capacity of 5 kg shall be used.

A-2.2 Standard Sand Testing Equipment for physical testing of sand such as, universal strength testing machine with the accessories required for making and testing:

a) Dog bone tensile specimen, and
b) Transverse/Bending specimen.

A-2.3 Core shooter with gas generator and source of dry compressed air for purging.

A-2.4 Core Hardness Tester

A-2.5 Gas Determinator

A-2.6 Thermometer, for indicating the atmospheric temperature.

A-2.7 Hygrometer, for indicating the atmospheric humidity at the location of experiment.

A-3 COMPOSITION OF STANDARD MIX

The composition of standard mix for amine cured cold box binder are,

a) sand (*see* **A-1.1**)
b) binder
c) hardner
d) catalyst

} As agreed to between the supplier and the user.

A-4 TEST CONDITIONS

Test conditions applied for the amine cured cold box binder are,

a) room temperature
b) relative humidity
c) shooting pressure
d) gassing pressure
e) gassing time
f) purging time

} As agreed to between the supplier and the user.

A-5 MIXING PROCEDURE

Charge weighed quantity of dry and clean sand in the mixer. Then add measured quantity of binder uniformly on the sand bed while the mixer is running and mix for 90 s; add hardener in the same manner and mix further for 90 s and discharge the mixed sand into a clean bucket. If dry additives are to be used, they are to be added to sand and mix for 60 s before adding liquid ingredients.

A-6 TESTING PROCEDURE

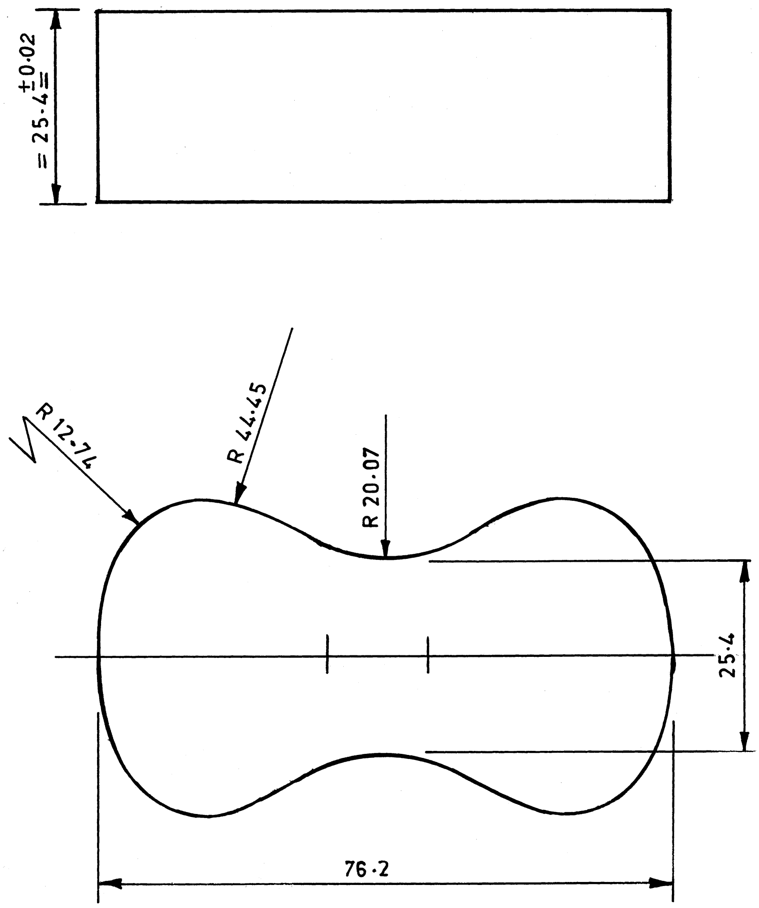
A-6.1 Test for bench life is given in **10.1**.

A-6.2 Test for Development of Core Strength

Immediately after the discharge of sand from the mixer, tensile specimen shall be made as given in Fig. 1. During sample preparations shooting pressure, gassing pressure and other parameters to be maintained as agreed to between the buyer and the supplier. Tensile strength of specimen shall be checked immediately after preparation. This is as gassed strength. Also scratch hardness shall be checked on two sides of the specimen along the horizontal surface. The scratch hardness shall be minimum 60. The tensile strength shall be observed at different interval of time at immediate 4th h and 24th h of gassing.

A minimum of three specimens should be tested to record an average strength value at any particular time.

A-6.3 The minimum tensile strength required when the sand is mixed with binder and hardener as per the specifications and conditions mentioned in **A-1.1** to **A-1.4**, at the intervals after discharge and made well within bench life shall be as agreed to between the supplier and the buyer. Other tests shall be carried out as per standard testing procedure adopted in foundry sand testing (*see* IS 1918).



All dimensions in millimetres.

FIG. 1 TENSILE TEST SPECIMEN

ANNEX B

(*Clause* 6)

SAMPLING AND CRITERIA FOR CONFORMITY

B-1 LOT

B-1.1 In any consignment, all the containers containing material of the same quality and manufactured under similar conditions of manufacture shall be grouped together to constitute a lot.

B-1.2 Samples shall be taken and tested from each lot for ascertaining the conformity.

B-2 SCALE OF SAMPLING

B-2.1 The number of container to be selected shall be according to col (2) and col (3) of Table 1.

B-2.2 The container shall be selected at random. For this purpose, the provisions given in IS 4905 shall be used.

Table 2 Scale of Sampling

(*Clause* B-2.1)

Sl No. (1)	No. of Container in the Lot (2)	No. of Container to be Selected (3)
i)	Up to 100	5
ii)	100 – 300	8
iii)	301 – 500	13
iv)	501 and above	20

B-3 PREPARATION OF TEST SAMPLES

From each of the selected container as per col 2 and col 3 of Table 1 with the help of a suitable sampling instruments 0.5 kg of the material shall be taken. This material shall be taken after homogenizing the content of the container by rolling it on the floor 5-6 times. Samples taken from each container shall be mixed to form a composite sample. This composite sample shall further be reduced to give a final sample of 1.5 kg. The sample thus obtained shall be further divided into 3 equal portions, one for the purchaser, the 2nd for the manufacturer and the 3rd shall be kept as reference sample.

B-4 NUMBER OF TEST AND CRITERIA FOR CONFORMITY

B-4.1 The sample prepared as per **B-3.1** shall be used to test for chemical, physical and sand mix properties.

B-4.2 If the sample fails to meet any one of the relevant requirements (*see* **B-4.1**) two further samples shall be taken and tested for requirement for which the sample has failed. If the material tested conforms to the relevant requirement while retesting two samples, the lot shall be declared as confirming to the specification, otherwise not.

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Amendments Issued Since Publication

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